12.—Observations on the reproductive biology of the dibbler, Antechinus apicalis (Marsupialia: Dasyuridae)

by P. Woolley*

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Abstract

The dibbler, *Antechinus apicalis* is a rare species and only 10 animals (3 wild-caught and 7 laboratory reared) were available for study. Comparisons with *A. stuartii* have been made to better interpret the limited data obtained. The dibbler breeds only once a year, in the autumn. Both males and females are sexually quiescent at other times of the year. The gestation period is estimated to be from 44 to 53 days. The young are dependent on the mother for approximately 4 months and they reach sexual maturity in the breeding season of the year following that in which they were born, when they are about 10 to 11 months old. There is some evidence that both males and females may breed in successive breeding seasons.

Introduction

In January 1967 Morcombe (1967) collected the first dibblers which had been seen for 83 years. Two specimens, one male and one female, were trapped. Later, in April 1967, Ride (1970) captured another female. These three dibblers were sent to the author at La Trobe University in May 1967 for study of their reproductive biology.

Reproductive Status of the Wild-caught Dibblers

Male 1 (trapped 28th January, 1967). In other species of *Antechinus* spermatozoa are found in the urine during the breeding season and the onset of spermatorrhea is associated with an increase in the size of the scrotum (Woolley, 1966a). Male 1 was not showing spermatorrhea when received in May. However, it may have been in breeding condition earlier in 1967, when the scrotum was reported to be large (Ride, pers. comm.).

Female 2 (trapped 26th January, 1967). In May the pouch area of this female was small and covered with short, pale hairs. The eight nipples were minute. The appearance of the pouch area was similar to that of other species of *Antechinus* prior to breeding (Woolley, 1966a). Female 2 therefore appeared either to be immature, or to have failed to suckle young in an earlier breeding season.

Female 3 (trapped 8th April, 1967). At the date of capture the pouch of this female contained no young, but the pouch area was covered with long, brown-stained hairs (Ride, pers. comm.). In other species of *Antechinus*, females which have reared young can be recognised by the discoloration of the pouch hairs which occurs during lactation (Woolley, 1966a). Ride's observation therefore suggested that female 3 had previously suckled young. Female 3 was examined again by Ride on 6th May and an uncounted number of small, hairless young were found in the pouch. These young must have been conceived in the wild before 8th April, since female 3 had been caged alone from the date of capture. When female 3 was received on 11th May, there were eight young in the pouch. By comparison with young of known age of other species of *Antechinus* (assuming similar growth rates) the young of dibbler female 3 were estimated to be two weeks old. Birth of the young therefore probably occurred late in April.

Maintenance of the Dibblers at La Trobe University

The animals were held in an air-conditioned room at approximately 21°C under the natural day length conditions of Melbourne. They were housed in cages that had been used previously for the successful maintenance of other species of *Antechinus*. The cages were made of stainless steel, 42 cm. x 31 cm. x 23 cm. high, with removable glass fronts. Each cage had a single detachable stainless steel nest box 13 cm. x 13 cm. x 13 cm. with access through a 5 cm. square hole on one end of the cage. The back and top of the cage were made of 3 mm. stainless steel mesh, on which the animals could climb. A sheet of corrugated cardboard, covered with wood shavings, bark and leaves, was used as floor covering and small pieces of cardboard and shredded paper were provided for nest material. The animals sometimes carried floor covering material into their nest boxes. Initially male 1 and female 2 were caged together and female 3, with pouch young, was caged alone.

The basic diet consisted of a mixture of raw minced meats, egg and fine ground dried puppy food, in the proportion of 450 g. sheep heart, 115 g. sheep liver, 1 sheep brain, 1 egg and 100 g. puppy food. The animals were fed once a day, in the late afternoon. Each animal was given 15 g. mince daily. Larger quantities were eaten by female 3 during the later stages of lactation. The basic diet was supplemented with insects and *Eucalyptus* and *Banksia* blossoms when available. Water, and honey diluted 1 to 5 with water, were provided *ad lib.*

History of the Dibblers in Captivity

Male 1 and female 2 (May-August 1967). From May to August, male 1 and female 2 were examined at irregular intervals of from 2 to 4 weeks.

* Department of Zoology, La Trobe University, Melbourne, Australia 3000.

Both animals were weighed. Urine was collected from the male to check for the occurrence of spermatorrhea and the width of the scrotum was measured. The pouch area of female 2 was inspected. No reproductive activity was observed during this period.

Female 3 and litter (May-August 1967). No attempt was made to study in detail the development of the pouch young. Under laboratory conditions the mortality of young during pouch life was found to be very high in *A. stuartii* and many young died when between 35 and 45 days old (Woolley, 1966b). Since this mortality may have been due to the regular handling to which the *stuartii* were subjected, the *apicalis* female with young was not handled at all until 22nd June, when the young were approximately eight weeks old. One young had been lost. The remaining seven were haired all over and their eyes were still closed. Up to 22nd June, female 3 was rarely observed out of the nest box during daylight hours, but in late June and early July she was frequently observed out in the cage with the young hanging from the nipples. She was first seen out without her young on 13th July and on the following day one juvenile was found out in the cage alone. The eyes were open and it was able to climb on the wire of the cage. During the last two weeks of July, the young were often seen out in the cage without the mother. On 30th July, when the young were approximately 13 weeks old, the female and young were examined. There were 3 male and 4 female young. The pouch area of female 3 was large and the pouch hairs a deep reddish-brown. The mammary tissue was enlarged and 6 nipples were elongated and appeared to be in use. The other 2 nipples were small and dirty. The female and young were found to be heavily infested with mites (*Ornithonyssus bacoti*). To reduce this infestation, the nest box and cage was cleaned frequently during August. The young were still suckling on 5th August and they were first observed to eat solid food on 6th August. Lactation probably ceased in mid-August, when the young were approximately 15 weeks old. Regression of the pouch area commenced at this time and was complete by mid-October. The duration of lactation in *A. apicalis* is therefore of the same order as that observed in *A. stuartii* by Marlow, 1961 (90 days) and by Woolley, 1966b (up to 108 days).

Wild-caught and laboratory reared animals (from September 1967). Early in September the dibblers were marked with their serial number by a system of toe clipping (Woolley, 1966b). The laboratory reared females were numbered 4, 5, 6 and 7, and the males 8, 9 and 10. Each male was caged with either one or two females. The combinations of males and females were changed as individuals died, and also during the period when it was expected that mating might occur. The animals were usually examined at intervals of two weeks throughout the remainder of 1967 and at weekly intervals while they were maintained in the laboratory in 1968. Males were weighed, the width of the scrotum measured and urine collected for examination for spermatozoa. Females were weighed and the pouch area inspected.

Observations on Reproduction in the Male

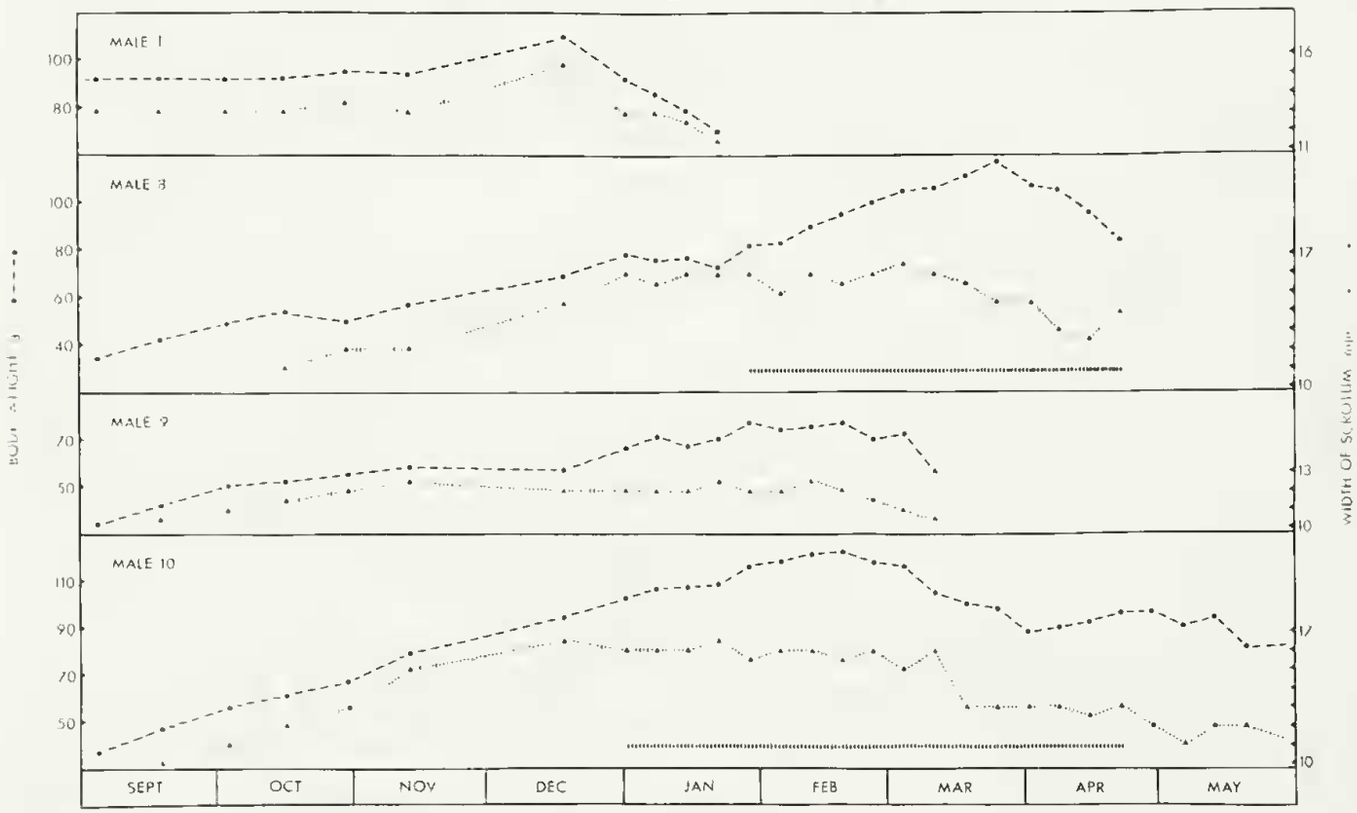

Figure 1.—Body weight and width of the scrotum of males. The occurrence of spermatorrhea is shown by the heavy broken line.

Figure 1 shows the body weight, width of the scrotum and the occurrence of spermatozoa in the urine for each male from September 1967 to the date of death (males 1, 8 and 9) or to the end of May 1968 (male 10). The males were killed at various times in 1968 when they became unhealthy. Histological sections were prepared of one testis and epididymis of each male. The occurrence of spermatogenesis and of spermatozoa in the testis, epididymis and urine at death is given in Table 1.

TABLE 1

The occurrence of spermatogenesis and spermatozoa in the four males at the date of death.

Male No.	Date of Death	Spermatogenesis	Spermatozoa		
			In Testis	In Epididymis	In Urine
1	24/1/68	Yes	No	No	No
8	26/4/68	No	Yes	Yes	Yes
9	11/3/68	No	Yes	Yes	No
10	25/9/68	No	No	No	No

Two males (8 and 10) showed spermatorrhea in January and spermatozoa continued to appear in the urine for approximately 4 months. As in *A. stuartii* (Woolley, 1966a) the body weight and width of the scrotum increased with the approach of the breeding season. In the dibbler scrotal width reached its highest level before the onset of spermatorrhea, and body weight was maximal during the period when the males were showing spermatorrhea. Male 8 was killed late in April, and, although spermatozoa were still present in the testis, epididymis and urine, spermatogenesis had ceased. Male 10 ceased to show spermatorrhea at the end of April. Males 1 and 9 did not show spermatorrhea. However, the occurrence of spermatogenic cell divisions in the testis of male 1 in January suggests that this male was coming into breeding condition at the time of death. In male 9, spermatogenesis had occurred, because there were spermatozoa in the testis and epididymis, but had ceased in March. There is no obvious explanation for the failure of male 9 to show spermatorrhea.

Observations on Reproduction in the Female

Mating occurred in March and April. The onset of oestrus was detected by observation of attempts by the males to court the females. The pattern of courtship and copulation was similar to that described for *A. stuartii* by Marlow (1961). Of the four females which were observed to mate, one copulated once, two twice, and one four times. When the females persistently resisted further attempts by the male to copulate the pairs were separated and the females caged alone. The maximum duration of a single copulation was 5 hours and the

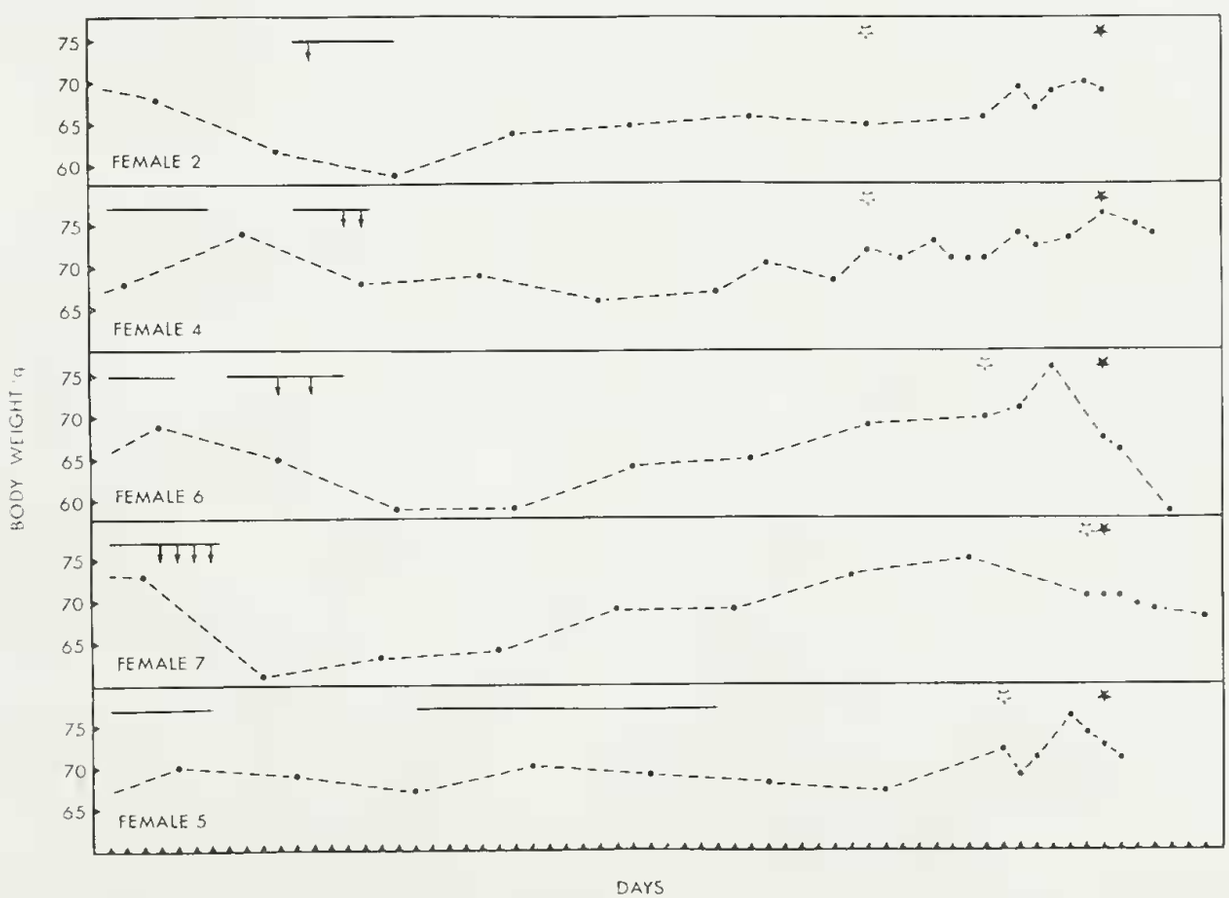

Figure 2.—Body weight of females during the breeding season, synchronised to the day of appearance of clear secretion in the pouch. The heavy line indicates the presence of a male in the cage with the female. ↓ copulation. ☆ pouch development first observed. ★ clear secretion in pouch.

13.—A salvage excavation in Devil's Lair, Western Australia

by C. E. Dortch* and D. Merrilees*

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Abstract

An open pit in the floor deposit of Devil's Lair (a small cave in the south west of Western Australia) which had been previously excavated, was filled to prevent further damage to a prehistoric archaeological site of considerable interest. Disturbed material found in the bottom and sides of this pit was first screened for animal remains and artifacts overlooked by previous collectors and a small volume of undisturbed deposit in one corner of the pit was excavated systematically. A report on animal remains and artifacts so recovered is given. The bottom of the deposit was not reached, but the upper 270 cm thickness appears to represent terminal Pleistocene and early Recent time, and contains artifacts and food remains left presumably by early Aborigines. Some of the animal remains recovered may have been left by "Tasmanian" devils or by owls. Mammal remains show no clearly recognizable climatic trends, but there is some suggestion that conditions were drier and/or warmer than the present during part of the time of accumulation of the deposit.

Introduction

Devil's Lair is a small cave in lithified aeolian dunes ("Coastal Limestone") in the Cape Leeuwin-Cape Naturaliste region, Western Australia.

Much of Devil's Lair has a thick flowstone floor. In 1955 a party led by E. L. Lundelius breached this floor and excavated the underlying earthy deposit to a depth of about 120 cm. Although Lundelius was concerned mainly with the remains of mammals and made no mention of archaeological material in his published reports (Lundelius 1960, 1966), he did find artifacts and a piece of baler shell which we believe to have been transported by man. Subsequent collectors also recovered a few artifacts and one of these collectors makes published reference to "possible artifacts" (Cook 1960). Archaeological aspects of the site were reconsidered when one of us (D.M.) noticed a human incisor tooth among kangaroo teeth recovered from the deposit by the Lundelius party (Merrilees 1968b). This tooth has been described by Davies (1968).

Devil's Lair opens from the same doline as a much larger cave, Nannup Cave. Lundelius (1960, 1966) and Cook (1960) use the name "Nannup Cave" for Devil's Lair but except perhaps in considering its geological origin, Devil's Lair is better regarded as distinct from Nannup Cave. Nannup Cave is listed as W60 and Devil's Lair as W61 in the Western Australian Speleological Group's system of recording cave sites (P. J. Bridge, personal communication).

The excavation made originally by the Lundelius party had been irregularly widened and deepened by subsequent collectors in the intervening 16 years. We decided to clean out disturbed material left by these collectors, to excavate systematically any undisturbed material within the boundaries set by previous excavators, to determine if possible the depth of the deposit, and then to fill the excavation to prevent further damage to the deposit.

Our party (see Acknowledgements) worked in the cave in December 1970, and this report summarizes our field observations and subsequent laboratory investigations, principally of the artifacts and faunal remains recovered, in what was essentially a salvage operation. Samples for sedimentological and palynological analysis were collected but have not yet been studied. We were unable to collect adequate samples of charcoal for dating.

We hope to make systematic excavations on a larger scale in Devil's Lair in due course, and to report our results in greater detail.

Our collections are preserved in the Western Australian Museum under catalogue numbers 70.12.1 to 70.12.1198, 71.1.1 to 71.1.283, 71.3.13 to 71.3.16, 71.6.1 and 71.437 to 71.472 (faunal); G13176, 13177 (lithological); A 21970 to 22028 and A 22113 to 22116 (archaeological).

For mammal names and taxonomic concepts, we follow Ride (1970).

The Excavation

The location of our excavation is shown in Fig. 1. It is referred to in our records as "Dortch Excavation, Trench A." We also cleaned out another smaller pit ("Small Excavation") left by previous excavators, and filled still another ("Shallow Excavation"), the positions of which are shown in Fig. 1.

Only the south west portion of our excavation yielded undisturbed deposit, the upper surface of which was detected about 16 cm below the flowstone floor of the cave. We followed this undisturbed material downward to a depth of 270 cm below the flowstone floor. At this depth, we considered that unsupported flowstone at the top of the excavation, and the irregular unsupported earth walls on the northern and eastern sides of the pit rendered further deepening of the pit dangerous.

We then drove iron rods into the floor in an endeavour to estimate the full depth of the deposit. These iron rods in places could be driven 170 cms below the floor of our excavation without encountering resistence. We had no iron rods of greater length, nor any other means of estimating the full depth of the deposit, which remains unknown but may be substantial. We then filled the whole pit, leaving plastic sheet and other markers of the limits reached.

* Western Australian Museum, Beaufort St., Perth.